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# The American Biology Teacher

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## The Cleveland Meeting

Each year *The American Biology Teacher* attempts to bring to its readers some of the highlights of the annual meeting. The condensed minutes and certain other items have already appeared. The new officers and the committee chairmen were included last month.

This month we include some of the contributions from the various program sessions. Some of these sessions were cooperative affairs, joint sessions of two or more of the cooperating societies, THE AMERICAN NATURE STUDY SOCIETY, THE NATIONAL SCIENCE TEACHERS ASSOCIATION and THE COOPERATIVE COMMITTEE of THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE. Other sessions were held by the individual organizations.

It is obviously impossible for *The American Biology Teacher* to report more than a small part of these sessions. There were more than a dozen separate program sessions, not including demonstrations, field trips, luncheons, general lectures and business meetings.

Some papers can be published just as presented, but many would be too long to print in full. If all were printed there would be considerable overlapping and near duplication.

Some of the most interesting contributions are in the nature of demonstrations and illustrated lectures. These cannot be transmuted into suitable magazine material.

We present this time the full text of four of the papers presented at various sessions, together with portions of several others. Several other papers will be presented from time to time. To the extent that space permits and as the papers become available, *The American Biology Teacher* will attempt as full as possible a coverage of the Cleveland meeting.

The opening program of the Cleveland convention was a joint session of all the cooperating societies. The theme was *Outdoor Resources for Learning Science*. President Dick Weaver and Julian Smith were two members of the panel of four. Weaver's paper appears below in outline form and Smith's in digest form.

# Using Outdoor Resources to Learn Science

RICHARD L. WEAVER

Director of Resource-Use Education, North Carolina Department of Public Instruction, Raleigh, North Carolina

## School Camping in North Carolina

Three school camps were held in 1950 in North Carolina by the Salisbury City Schools, one for eighty-seven sixth graders, one for forty-two high school biology students and one for sixty-six teachers. All were held at the Kings Mountain State Park in South Carolina, the children's camps lasting five days and the teachers' camp three days.

There was a great deal of similarity in the three separate camps in the preplanning, in the program at the camp, in the way resource people were used and in the projects undertaken.

Superintendent J. H. Knox chose principals as camp directors and appointed committees of teachers, principals and supervisors to plan and execute the three programs. Teachers and supervisors served as staff in the two camps for students. Resource people from the Health Department, Extension Service, Soil Conservation Service, Forestry Service, Department of Conservation and Development, Wildlife Resources Commission, Park Service, State Geologist's Office, and the Department of Public Instruction were used to assist the staff in the instructional program.

The program was organized around

the fields of forestry, soil and water conservation, wildlife, geology, and nature study. Projects were selected where the children could do the work and learn the principles of resource management through participation.

The resource people were asked to assist on specific activities and instructed to limit their talks and instructions. Every effort was made to "learn by doing." Evening periods were arranged for questions, films, and short talks.

These were some of the projects and activities in the three camps:

### Forestry

1. Learned how to transplant trees.
2. Planted a "camp tree" as well as some seedlings.
3. Studied and compared ten posts around the parking lot to see how trees grow.
4. Selected trees which should be thinned in a fourth-acre plot.
5. Measured the board feet of ten trees and computed the value of them.
6. Studied trees in the camp area and learned how to identify fifteen of them.
7. Examined a forest fire fighting truck.
8. Viewed "Dead Out," a film on forest fire fighting.

### Soil Conservation

1. Studied the signs of erosion about camp.
2. Examined the old terraces on the old farm now being used as a park.
3. Examined the soils of camp in the fields, woods, above and below terraces, etc., with a soil auger.
4. Planted a roadside area to stop the erosion and to beautify the entrance to camp.
5. Brushed a "galded spot" to stop erosion.
6. Built some stone barriers in gullies along the road to prevent silting in culverts.
7. Placed some log barriers across paths in the camp which were eroding.
8. Viewed some films on soil conservation and modern agriculture.

### Wildlife Management

1. Planted *Lespedeza bicolor* and *Multiflora* rose along the edges of the fields.
2. Studied signs of game birds and mammals

in camp area.
3. Trapped small mammals to see availability of food for larger animals.
4. Collected fish foods in the stream near camp. Studied them under a bioscope.
5. Participated in casting on the lake.
6. Examined specimens of fish, birds and mammals loaned by the State Museum.

NATURE STUDY

1. Explored the camp environment and learned:

   10–15 birds.
   10–15 trees.
   As many amphibia and reptiles as could be located.
   10 constellations.
   10–15 wildflowers.

2. Examined three quarries near camp—mica, feldspar and barite (teachers' camp).
3. Identified and sprayed poison ivy around the camp with 2,4-D.

HISTORY

1. Examined the battle ground of the Revolutionary Battle of Kings Mountain.
2. Heard a talk at the Park Museum on the battle and the history of the area.
3. Visited an old Revolutionary Church enroute to camp.

AGRICULTURE

1. Visited a dairy farm to study modern agricultural practices enroute to camp.

FOLLOW-UP

The students prepared notebooks on the projects at camp and reported their experiences to those unable to attend. Children, parents and teachers agreed that they had learned so much that was valuable and that could not be learned inside the classrooms, that Salisbury was ready to continue school camping as a regular part of the school program.

These three pilot camps in the State will do much to encourage other school systems in North Carolina to undertake similar camps.

# Outdoor Resources for Learning Science

JULIAN W. SMITH

Chief, Health, Physical Education, Recreation, School Camping, and Outdoor Education, Department of Public Instruction, Lansing, Michigan

SCIENCE IN THE OUT-OF-DOORS

Many of the things with which science deals are in the out-of-doors. The environment in which man lives, made up of what some call "Mother Nature," is teeming with life—plants, animals, and an infinitesimal number of living beings. Then there is the physical environment—the air, water, and soil—which so many take for granted in modern society. All of these things make a difference in man's living. Yet, when they are studied in our traditional science classes, they are treated largely as abstract facts; or, in the event a laboratory is provided, the natural things are pressed, preserved, and pickled, and stored in dingy classrooms.

THE OUT-OF-DOORS—AN EXPERIMENTAL CURRICULUM

Learning science in the out-of-doors, whether it be in camps or through field trips and excursions, is sound educationally. It can be proved, by countless documents, that learning takes place best when the learner can have a direct experience or when he can at least see the objects about which he is being taught. "Learning by doing" is an old adage, but one that is curriculum wise. Thus outdoor education, whether it be for science purposes or for many of the

other unique learnings, is in keeping with all we know about how human beings learn. Not only is the learning effective through direct experience in the out-of-doors, but it is adventuresome and pleasant. This is an application of another one of the well-known laws of learning and, in modern education, there is no stigma attached to being happy while one is learning.

### Outdoor Education Resources

Someone has said that outdoor education begins when one opens a classroom door. In most places, one can see some of the natural beauty of the out-of-doors by getting outside of a classroom. Starting with this experience and extending to extensive field trips, excursions, and camping, the outdoor laboratory can be used effectively in the present curriculum. In addition, however, there are some learnings that can take place only in the out-of-doors, and modern schools are now beginning to provide opportunities for such out-of-classroom experiences. The development of school camps is evidence of this fact.

In Michigan, upwards of 60 schools last year provided a week or more of camping as a part of the regular school curriculum. Some schools are already operating camps on a year-round basis. The program descriptions from these camps are rich in natural science and conservation learnings. Boys and girls and teachers go to camp together, oftentimes for a period of a week or more. The camps are cooperatively planned, and the activities are selected by the students. The whole camp environment is utilized as a laboratory for informal learning. Whether the activity be labeled a hike, a cook-out, or a special trip over the area, the opportunities for a new understanding and appreciation of the natural environment and resources is significant.

### Outdoor Learning Experiences

The areas of learning in which camping and outdoor education make a unique contribution are listed as follows:

1. Social living.
2. Healthful living.
3. Understanding of conservation and the physical environment.
4. Purposeful work experiences.
5. Recreational living.
6. Outdoor education activities, which include a wide variety of applications of subject matter areas.

Some of the activities often found in school camps that have implications for science are as follows:

1. Game and fish.
2. Developing a library and simple museum.
3. Understanding of forests, soil, and water through visits to points of special interest.
4. Activities in geology through visits to stone quarry, gravel pits, etc.
5. Weather station activities.
6. Making maple sugar.
7. Photography.
8. Study of stars.
9. Use of simple keys for identification.
10. Museum preparation, such as elementary taxidermy, foliage impressions, and making casts of animal tracks.
11. Use of compass.
12. Activities involving land use and types of soil.
13. Sanitation.
14. Water testing.
15. Use of fish-shocking equipment.
16. Study of poison plants and methods of protection.
17. Use of plants for food.
18. Use of fire-fighting equipment.
19. Development of nature trails.
20. Mapping and aerial photo interpretation.

These are only a few of the possible outdoor resources for learning science. In school camps in Michigan, some unique

learnings have come out of the conservation-centered work projects, where boys and girls actually learn by doing. These include: forestry operations, land surveys, soil conservation activities, game and fish management, building projects, park improvement, and others. Many camp activities centering around food, clothing, and shelter also involve science.

Much could be said about teaching methods in the out-of-doors. Obviously, formal methods are not appropriate, and the real success of a good outdoor education program is the adaptation of student needs and abilities. Teachers who are well trained in understanding child growth and development, and who do have a general understanding of the out-of-doors, should guarantee good learning situations for boys and girls. The modern emphasis on ecology and land use is a clue to better understanding of the sciences and conservation.

### The New Community School

The modern concept of the community school takes in the entire community, with the school building as the center; the industries, agriculture, and the open country become fascinating new laboratories. For a long time, this concept has been the hope of those interested in children. The essential learnings, such as the sciences, will find their rightful places because they are part of the environment.

The story of school camping and outdoor education is simple. It means that boys and girls and their teachers find new learning experiences in the presence of the workings of science—surrounded by the great natural resources. Learning is direct and simple. There is opportunity for actual experience—for seeing, feeling, tasting, and smelling the freshness of the woods, fields, lakes, and streams . . . the open prairies or snow-capped mountains. It is only the lack of ingenuity that has kept education from utilizing all of the resources, outdoor and otherwise, in the educational process of all the people. The resources are here. There are millions of acres of public lands. There are thousands of camps, and countless trails, waiting for eager and red-blooded youth to experience new frontiers.

The schools and the colleges and many other agencies in the community should join forces in making better living and education available. It will not only make for the improved learning and understanding of science—this concept of community education will make better human beings.

# The Conservation–Natural Resource Use Workshop*

LEO F. HADSALL
Fresno State College, Fresno, California

American educators face the problems of developing citizens able to get along with one another; and citizens who will utilize their natural environment so that it will furnish an ample sustenance for the present generation and continue to provide for generations yet to come. The first problem demands immediate and constant attention whether it be in a home, in a community, or in relations which involve nations. My primary con-

* Presented at joint session American Nature Study Society and National Association of Biology Teachers, Cleveland, Ohio, December 27, 1950.

cern is the problem of training citizens to get along with their environment and to use it in wise fashion. I am concerned with the problem of teacher training.

The student of nature study, the ecologist, is conscious that human life, like other forms of life, is limited by environmental factors. We are "bound" to the soil. The central valley of California where I am located is limited in its development, agriculturally and otherwise, by the water which may be supplied through irrigation. Its future population will depend in large measure on the extent to which an adequate supply of good water may be provided. Water is an essential component of protoplasm. Protoplasm is the basic substance of which living things are composed.

We have seen increasing evidence of natural science instruction in public schools; but recently there has been a trend towards emphasis on generalizations. Many of these are supplied in textbook form and they are being parroted throughout our public schools. Is this sound instruction? I think not!

We cannot attack the problem of conservation education solely through the printed page. Children need specific, primary, sensory experiences more than they need vicarious experiences and generalizations. Generalizations are in the majority of cases partial truths. To provide children with numerous specific, primary experiences we must concern ourselves with training teachers to explore and interpret the immediate environment with their pupils.

Alert, well-informed, skillful teachers are a prime requisite for effective public education. But they must also have a desirable point of view as emphasized by Liberty Hyde Bailey in "The Nature Study Idea." Their skills must include teaching the fundamentals but they will ease their task and increase their effectiveness if they approach these through studies of their immediate environment. Teachers need to become acquainted with resource persons as well as areas. They need an adequate supply of instructional materials pertinent to local areas. Soil conservation problems in northeastern Pennsylvania may be very different from soil conservation problems on alkaline lands of portions of the San Joaquin Valley. In cooperation with resource people teachers may develop practical educational materials which will be useful in the hands of children.

### Assistance to Inservice Teachers

Assistance to inservice teachers in conservation education has come from state departments of education, state departments of conservation and natural resources, federal agencies, universities and colleges, and to lesser extents private agencies. Among these efforts have been customary college lecture courses conducted by a single individual, or in an improved form with the assistance of representatives of public and private agencies; extramural classes; correspondence instruction; teachers institute service; public meetings—conferences; curriculum guides prepared by local school supervisors and teachers, state departments of education, state departments of conservation, and federal agencies; publications issued by state departments and colleges, such as the Science Guide for Elementary Schools in California and its noted prototype the Cornell Rural School Leaflet issued by the New York State College of Agriculture at Cornell University; visual aids; radio programs; demonstration areas; playgrounds; camps; outdoor laboratories; field trips including conservation tours or caravans; and workshops.

Workshops have become popular means of assisting inservice teachers in conservation education. They vary in length from one day to nine weeks.

They also vary in scope of activities and in method of operation. The conservation workshop has been defined as "a group working together to develop individual and group plans for partial or full solutions of problems of its individual members and of the group itself." I would point out that this is not necessarily so. A workshop may provide preliminary background of information and training. It may result in the development of a desirable point of view.

In 1949 and 1950, conservation–natural resources use workshops were conducted by the Fresno State College in cooperation with the California State Department of Education, State Department of Natural Resources, State Division of Highways, University of California, United States Bureau of Mines, United States Army Engineers, Bureau of Reclamation, United States Soil Conservation Service, United States Forest Service, National Park Service, Fresno County Planning Commission, and private agencies including the Kings River Water Association, Standard Oil Company of California, Pacific Gas and Electric Corporation, Southern Edison Company of California, and Peerless Pump Division, Food, Machinery and Chemical Corporation.

### Planning the Conservation Workshop

In planning the workshop the following problems were considered:

1. What do the various Federal, State and private agencies have to offer that would be valuable to curriculum workers, administrators, and teachers?
2. How should the workshop be organized to secure the most desirable results?
   a. Which governmental and private agencies should be invited to participate?
   b. What should the participating organizations be asked to provide in the way of printed helps; discussion and study outlines;—visual materials—films, pictures, and slides; field excursions—leadership, transportation; classroom presentations and discussions; and scholarships?
   c. How should the workshop time be distributed among the following phases of conservation—oil and other mineral resources; soil conservation including reclamation, range management and land use; federal and state forestry activities; private industry; water problems; wildlife; community planning; and recreation?
   d. What portion of the time should be allotted to formal presentations, group discussions, field excursions, examination of published materials, visual aids, and preparation of curriculum materials?
   e. What field excursions should be scheduled in connection with forestry—State, Federal and private; oil and other minerals; water problems; hydro-electric production; agriculture—range management, crop rotation, alkali reclamation; soil erosion—wind breaks; wildlife; community planning; and recreational areas?
   f. To what extent could the State Department of Education, the State Department of Natural Resources, and county and city school administrators provide staff members to work with the agencies and teachers in developing curriculum materials?
   g. What form of report or curriculum plans should be an outcome of the workshop? How could this be developed best?
3. How could the participants in the workshop be selected to secure the most effective results?
   a. What limitations should be set on enrolment?
   b. To what extent could the State Department of Education and the State Department of Natural Resources assist in securing participants?
   d. How could county and city school administrations assist in encouraging supervisors, principals, secondary

teachers and elementary teachers to participate in the workshop? What recognition could be given for attendance in addition to growth credit or financial assistance in the form of bonuses?

d. To what extent could local civic and private organizations be interested in sponsoring the attendance of local administrators, supervisors and teachers?

4. How could the college best present the program to public school administrators, supervisors, and teachers? In addition to printed announcements and radio what other means could be used to stimulate interest?

5. What should each participant in the workshop be expected to provide? Some of the items agreed upon were enrolment fee, notebooks, field clothing, blankets, food, provision for collecting and camera if desired. It was agreed to provide common transportation on a cost basis.

Teachers, supervisors, school administrators, and consultants from the State Department of Education joined in considering these problems and a two weeks field program was conducted in 1949 and a three weeks field program was conducted in 1950. The 1949 program was conducted in June prior to the opening of the regular summer session and the 1950 program followed the regular summer session. These dates were determined because some participants wished to attend the regular summer session and there was overlapping demand on the time of staff members.

### Field Experiences

Field experiences during the 1950 session included visits to the Pine Flat Dam under construction, Friant Dam now completed and the Fresno Irrigation District. There is strong feeling locally and divergent views regarding private operation of irrigation districts, the work of the Bureau of Reclamation, and the efforts of the United States Army Engineers in flood control. Various views were presented by leaders from these agencies and the relation of private hydroelectric plants and distribution systems considered. Field trips were made to consider soil conservation, and land utilization. Range management including brush burning, another highly controversial topic; wind erosion, water erosion, soil testing and weed control were studied afield under the guidance of specialists in their respective fields. Forestry activities including timber sales, logging operations, lumber mill operations, fire control, insect and rust control, and recreation developments were viewed first hand. Mineral and oil studies involved excursions through the historical Mother Lode country, the Coalinga and Kettleman Hill oil fields, the Richmond Refinery and Research Laboratories through the courtesy of the State Department of Mines and the Standard Oil Company of California.

Overnight stays were made at Asilomar, Richmond, Sequoia National Park and Yosemite National Park. Sea Cliff Beach State Park and Point Lobos Reserve were visited. An excursion was made to consider the needs and benefits derived from highway, rural and community planning. The last trip by cars was made to hydroelectric plants on the San Joaquin River. Two major private power companies have constructed a series of power houses on this Sierra stream. To facilitate their operation three artificial lakes have been constructed in the mountains. After the water has passed down the river through a series of power houses it is stored in Lake Millerton behind Friant Dam. Friant Dam is an integral part of the Central Valley project operated by the Bureau of Reclamation. The multiple use of water in this stream is a good example of benefits derived from cooperative efforts of private industry and

public projects. The last day of the workshop session members of the group took turns flying over much of the area they had visited by car. Small planes were used to provide greater visibility.

### Field Reports

The scope of the workshop was too great and the time consumed in travel too much to permit students to prepare reports on all areas. At the beginning of the workshop period committees were set up to report on wildlife, water and water problems, hydroelectric development, forestry, national and state parks and recreation, soil conservation including land utilization, minerals including natural gas and petroleum, and community planning.

In anticipation of limited time in the field program consultants from the State Department of Education, cooperating with key teachers and supervisors, developed the following form for field reports:

1. Topic—such as water and water problems.
2. Purpose of field trips.
3. Narrative account of trips primarily concerned with this area.
4. Valuable learnings received from trips.
5. Elementary social studies units now in use with which these learning experiences correlate on the primary, intermediate and upper grade levels. Other elementary areas of learning with which these experiences could be integrated.
6. Secondary school courses and grade levels in which these learning experiences are or could be provided such as agriculture, homemaking, industrial arts, language arts, science and social studies.
7. Are resources available to provide these learning experiences in your community? County? If so, list the area or areas which might reasonably be expected to provide such learning opportunities.
8. Which basic conservation concepts did these learnings develop?
9. Did the learning experiences provided by these trips change your attitude in respect to the conservation and use of this resource? If so, how?
10. Prepare a list of selected publications or films considered pertinent to this area of conservation.

By dividing the areas to be reported on each participant was able to concentrate on one area, although participating in the field experiences of all areas. The reports of the various committees have been assembled and duplicated for distribution to the participants, and on a limited basis to other interested parties by the California State Department of Education.

### Reaction of Participants

The value of the field program may be measured in part by the reaction of the participants. At the beginning of the final week they were requested to indicate the most outstanding experience of personal interest to them in the program. In this outdoor session the following oral responses were tabulated:

"The opportunity to see the oil industry from oil field through the refinery."

"The severe evidence of soil erosion due to previous overgrazing in Big Meadow, Sequoia National Forest."

"The crowded camping conditions at Bass Lake and Yosemite National Park."

"The program of the United States Forestry Service in growing and harvesting timber on a sustained yield basis."

"The many good examples of soil conservation practices."

"The operations in the sawmill at Northfork."

"The breath-taking experiences at Buck Rock, Forest Service fire lookout."

"The peace and quiet in the groves of giant Sequoias."

"Mr. C. M. Goethe's talk on natural history at Point Lobos."

"The need for school children to have camping and outdoor experiences."

"The graphic geological story of Yosemite Valley."

"The historical Mother Lode country and the effects of early day mining."

"The Friant-Kern Canal siphon under the Kings River."

"The value of the coyote in controlling rodents."

The varied responses are indicative of the effectiveness of stimulating first-hand experiences as well as previous conditioning. The following statements of influenced or changed attitudes of participants are typical of others contained in the 1950 committee reports:

"My knowledge of plants and animals and the interrelations of nature were increased. With this came an increased appreciation of our natural heritage and a stronger realization of our responsibility to preserve it."

"I have become aware of the problem of satisfying all interests involved in the water dispute and the necessity of the people as a whole to become aware and guard their interests. I had previously thought of water as the concern of the farmer and not as a resource belonging to me personally, thereby demanding my attention. I learned that there are many ways that a farmer can use or misuse water and that this may ultimately mean scarcity of water for the city in which I live, and a resulting substitution for fine drinking water. I am more acutely aware of the difference water makes on the west side of the San Joaquin Valley, after noting the different sizes of farms as pointed out on the plane trip."

"I never realized the magnitude of the conservation problem, nor did I realize the extent that so many agencies and sincere individuals were at work on the problem."

"My experience in this workshop convinces me that only through basic instruction in the schools can our resources be perpetuated. This instruction must be through functional experiences."

"The learning experiences helped to supplement, sharpen, and coordinate past ideas and views on conservation. They further provided concrete examples which shall remain vivid in our minds."

## Evaluation

Public school administrators have been slow in responding to this offering. Nor have school supervisors been quick to respond. Like many teachers, some supervisors may be classified properly as sedentary species. On the other hand, public and private agencies concerned with resource use have been quick to respond. Most of them are fully aware that the information of the specialist must become the property of each citizen if waste due to ignorance or greed are to be controlled.

Teachers from the kindergarten through all levels of the elementary school; high school teachers of general science, biology, English, industrial arts, and science worked together with a limited number of supervisors without segregation. Benefits were derived from sharing the viewpoints of others on different instructional levels. The need for more time for curriculum planning was keenly felt. Some planning was done with small groups enroute. A field or laboratory program should precede or go along with curriculum construction. Curriculum planning may be effectively handled by local and state committees if curriculum workers have had ample primary experiences to provide a broad point of view.

The contacts of school people with public and private agencies through the field program opened new avenues of assistance in planning and executing school programs. Public and private agencies became more familiar with the needs of those engaged in instruction. Attention has been focused on the need for preparing accurate, specific, printed helps on local areas for teachers and pupils. Interest has been aroused in developing visual materials covering portions of the local area which may not be easily reached with school groups.

There may be advantages in concentrating on one phase of conservation such as forestry or soils. It is possible that such a program would not require extensive travel and might be well handled in a laboratory situation. But conservation problems may be complex. They vary in importance with different regions. The type of program for inservice teachers which any institution should adopt should be determined in part by the needs of local teachers and the qualifications of local leaders. Preferably it should not be limited to one type of inservice assistance. Leaders should always be on guard against the development of single-purpose conservation. It is likely that any program attempted will be modified in the light of experience and varying needs. Central California lends itself ideally to a program of field experiences. Through carefully selected field experiences teachers, supervisors, and administrators may develop a background of information, attain techniques of attacking conservation problems, and acquire a desirable point of view.

The following two papers are digests of the contributions of Mr. Loomis and Mr. Mann to the NABT session on *Special Techniques in the Teaching of Biology*, December 29, 1950.

# The Importance of Photosynthesis in Biology Teaching

W. E. LOOMIS
Iowa State College, Ames, Iowa

The old saw which says: "The way to a man's heart is through his stomach," seems to have fallen into disuse by the younger generation of young ladies. Perhaps they have found an easier road. It is still the basis of our wooing of European Communists, however, and can be a useful approach to plant biology. Foods and feeds come from plants, which are our only source of body energy, our only source of primary amino acids, and our principal, if not our only, source of vitamin materials. Animal foods represent desirable concentrations of amino acids and animal protein factor as well as titillating flavors, but their dietary value is derived entirely from plants.

Basically the synthesis of carbohydrates from carbon dioxide and water by green plants is no more significant to biology and to life than the synthesis of amino acids from sugars and inorganic nitrogen by green or non-green plants. Photosynthesis, however, represents large volume production, is perhaps a more complicated process, and has caught the public eye because of its fixation of sunlight energy. Iowa's 100 billion corn plants, will together produce some 30 million tons of sugar equivalent in 100 days.

After attempting to impress our students at Ames with the everyday importance to each of them of plants and plant production, we may start a study of food production by plants with a discussion of how much of an original 10 kg. of fertile soil will be left in a pot after producing a corn or cotton or tomato plant having a dry weight of 1 kg. The discussion will be followed by burning a weighed quantity of dry plant material and noting the energy (heat) liberated, the water which will condense from the smoke onto a cold beaker, and the loss of weight from plant material to

ash. If the material is burned in a combustion tube the water can be collected in a test tube packed in dry ice or in salt and ice, and the production of carbon dioxide demonstrated by drawing combustion gases through barium hydroxide solution.

Having demonstrated water, carbon dioxide and energy as decomposition products of plant material, we are ready to start studies of the synthetic reactions. Water is passed over briefly as almost certainly coming from the soil. Carbon could come from the air or soil. With a certain amount of slanting by the instructor, the class works out an experiment for testing starch production by plants in ventilated bell jars and in jars containing a carbon dioxide absorbent. The results may be checked by transferring a bubbling sprig of *Elodea* in light from fresh tap water to boiled water cooled under a carbon dioxide absorbent, where bubbling should stop at once. In discussing the results of the experiment the relative availability and mobility of the carbon of the air and soil are brought out and a quick calculation is run to show that the available quantity of carbon dioxide is on the order of 20 tons an acre while the available phosphorus, for example, may be only a few grams an acre.

Energy could be obtained from heat or radiation. Growing plants in a warm, dark place or in a cooler location in the light will demonstrate the necessity of radiant energy. In a second experiment bubbling from a sprig of *Elodea* may be measured at varying distances from an unshaded mazda lamp of 500 to 1000 watts. After noting that the light scatters over a sphere whose area increases as the square of the distance from the filament, the students plot rate of bubbling against relative light intensity.

The role of chlorophyll is demonstrated with a variegated *Coleus* leaf; part red, part green and part red plus green. Although the red pigment absorbs radiation, no starch is formed unless chlorophyll is present. Finally the bubbles given off by *Elodea* or some alga are collected under water and tested for oxygen enrichment, which should run to 50 or 60 per cent.

Even if demonstrations are used for the experimental work, the program outlined here will require two to four 2-hour laboratory periods. It will, however, offer many opportunities for both deductive and inductive reasoning on the part of the students, and should give them an appreciation of the basic importance of plants in Biology.

# Using Sanctuaries, School Forests and School Grounds

ROBERTS MANN

Superintendent of Conservation, Forest Preserve District of Cook County, Illinois

In previous sessions at this meeting you have heard about school camps, field trips, and natural history museums as adjuncts to the teaching of the biological sciences. I shall devote much of my time to the objectives of day camps in the Chicago region, and the techniques employed by our Forest Preserve District naturalists in such day camps. I do so because I believe they can be employed profitably in the teaching of biology elsewhere—in sanctuaries, school forests, and even on school grounds—in Peoria or in Podunk, relatively speak-

ing—as well as in Chicago.

We employed 11 extra naturalists last summer and provided naturalist service for 101 of 116 day camps operating in our preserves. Each of approximately 10,000 children had at least four 50-minute nature walks with a naturalist—merely an *introduction* to the out-of-doors, of course.

A day camp is a wholly daytime experience in outdoor living by a group of children—in our case, conducted by some youth organization or social agency. A *good* day camp is one conducted in a natural environment—the wilder the better. It is not merely an outing. Its program should include nature study; and *all* activities should have nature significance.

So we are primarily concerned with the teaching of *nature appreciation;* man's dependence upon the land; the interrelationships and interdependencies of *everything* in nature, including man himself. We try to make children realize that they can have *fun* out-of-doors, without killing or destroying; make them feel at home there; open their eyes to what they can see, touch, hear and taste; help them become familiar with their locality: its geographical and physiographical history, its human history, its soil, its flora and fauna—its ecology.

Our ideal naturalist-teacher has a broad background of outdoor experience such as one gets on a farm or in a small town, plus broad training in the biological sciences with emphasis on natural history and ecology. He must have a contagious enthusiasm for the out-of-doors and a desire to share its riches with others. He must like people, especially children; be congenial, and have tact. He must have the ability to express ideas well and relate them to common experiences. He must have humor but it must not be "corny." He must be humble, with the dignity of the truly humble, and have the courage to say, "I don't know. Let's find out." He must sense the dramatic qualities of things or situations and seize upon such opportunities to stimulate the interest and the imagination of a group. He must be an opportunist with that flexibility of mind which will enable him to adapt his presentation to the level of understanding and the social-economic background of an individual or a group.

There are such individuals, male and female, but they're hard to find. For years, I've been telling our universities and some of our great teachers that they should be training such people. The demand now exceeds the supply.

For two years, before our Outdoor Education programs really got up steam, and while we were selling the day camp idea to youth organizations, we conducted experimental field trips to find out what makes Chicago kids "tick." The groups were "selected" in that each had approximately equal numbers of boys and girls, parental consent was required, and each group contained a good cross-section of a chosen room or class: varying I.Q.'s; plus a few individuals known to be unsocial or otherwise maladjusted, or lacking desirable aptitude or attitudes in their school work. One suburban group of 6th grade children was taken out on Wednesday mornings during school hours. The others were taken out from 9 a.m. until 3 p.m. every other Saturday during an entire semester. One group of high school biology pupils came from a swanky suburb; another—all negroes—from Chicago's near south side. The 6th grade groups varied likewise as to economic and environmental background.

Each trip was different, suited to the season and the weather on that particular day. Even on bad days they spent much of the time outdoors in short intervals. On such days we also used visual

aids. In March we took them to a big slough when the ice was breaking up.

In April we visited our hardwood nursery where they learned how to propagate and actually transplant young trees and shrubs. One trip was to a limestone quarry rich in fossils. Another was to a big farm and for most of them this was a unique memorable experience. They fished at one of our lakes with crude poles and, after they had learned to recognize the different kinds of fish they caught, plus what we caught in nets, we cleaned and fried those fish for them to eat. We had them turn over and tear apart rotting logs. We had them sift each of the first six one-inch layers of a square foot of different soils, count the visible animal organisms in each layer, and compute how many that would mean per acre. On each trip, as they went along, they learned to recognize the common trees, weeds—and especially edible plants—wildflowers, birds, mammals, reptiles, amphibians, soil types and cloud formations.

They were taught to fear nothing, including snakes, and to handle snakes, worms, insects, fish and mice. They were taught to see the beauty in the jewelled eye of a toad and the chrysalis of a Monarch butterfly. They were given old coffee jars and allowed to take home live snakes, frogs, turtles, mice, minnows, insects, old birds' nests, and skeletons. The groups reported back to their respective classes what they saw on each trip and exhibited their collections. Their classrooms were transformed into nature centers. But they were not graded. Nor were they required to keep notebooks, although many did so. Above all they had *fun*.

The qualitative results of a semester of such trips, as supplied us by the school authorities, were remarkable. The intangible benefits were even more important than the tangible. We proved, too, that a child can learn and have fun doing it—in fact, he'll learn quicker. Those experimental field trips set the pattern for our day camp naturalists' techniques.

Some children are interested in one thing; some in another. Most of them are interested in insects; some will want to make collections of insects, or of rocks and pebbles, and this should be encouraged by showing them how to do so. Some, particularly girls, will want to make collections of leaves and flowers. They should be shown how to collect and preserve leaves, and various methods of making leaf prints, but shown why the picking of wildflowers cannot be permitted.

Most children are interested in aquatic life. Water and all the things that live in it—fish, turtles, crayfish, frogs, tadpoles, mussels, insects, and even plants—seem to draw kids like a magnet, especially boys interested in little else. All of them are fascinated by snakes. All of them can be taught to handle snakes without fear or revulsion. Boisterous pranksters must not be permitted to frighten others. We always place a snake in a box or bag where the timid squeamish girls can gradually, by their own devious avenues of approach, overcome their acquired prejudices and satisfy their curiosity.

You may find a rare individual interested in nothing—apathetic, inattentive and unresponsive. Watch that child unobtrusively. Don't give up. There is something that will interest him. Discovery of new facts in nature can be exciting adventure. *Discovery* and *adventure* are among the chief values of any field trip, day camp, or other outdoor experience to any boy or girl. But, as one of our naturalists from Cornell phrases it: "Your greatest task is to create and hold the child's confidence, respect and admiration. Once they start

calling you 'Nature Boy,' you're in."

In a day camp the naturalist takes the children out in successive groups of 15 to 30, each with one or more unit counselors, on 50-minute nature walks. As a rule, on his first visit, the primary theme—or area of study—is Plants. There may be one or more secondary themes sandwiched in if the area and opportunity permit. For instance, if they see a groundhog or capture a snake, all bets are off for quite some time. Poison ivy, edible plants or their fruits, and their uses by pioneers or Indians are stressed, along with common trees, shrubs, vines, weeds and wildflowers. On the second visit the primary theme is Aquatic Life; on the third: Land Animals and Their Homes, including insects, and the naturalist usually has a pet snake, turtle, frog, squirrel or a defrosted skunk for the kids to handle. The fourth visit is devoted to Soil and Life in the Soil, including some geology.

The order of primary themes may vary according to the weather. Most walks follow a looping course, with a simple treasure hunt or other game played on the way back to the camp site, as a review of what has been seen and said. Where we know that a naturalist can be assigned to a group on more than four days, the primary themes may be subdivided.

Back in camp, the other units of the camping group may be playing nature games or working on arts and crafts utilizing native materials. Every winter, now, we conduct 2-day or 3-day workshops in which 300 or 400 day camp directors and counselors receive instruction, literature and actual practice in such games and crafts. The success of a day camp, the gain per child, and the value of a naturalist's services are directly proportional to the quality of the camp organization, the quality of leadership, and the training given the leaders. Therefore, each spring and each fall, we conduct courses for day camp directors and counselors—most of them volunteer workers. Usually, those courses include one indoor session and at least four 6-hour outdoor sessions.

Eventually, many youth organizations and social agencies will employ full-time naturalists. I also hope to see the day when the elementary schools will employ naturalist-teachers, just as they now employ art teachers, music teachers and physical-education teachers. When that millenium arrives, maybe every child in the 5th, 6th, 7th and 8th grades of the public and parochial schools in Chicago and Cook County will experience at least four field trips per year. Perhaps each school will have a small plot of ground for wildflowers, bird feeding stations, angleworms and such. You can teach *some* biology in a vacant weed-grown lot, or along a city street, but you almost need the genius of a Fabre or a—or is it an—Agassiz to do it.

In the meantime, the day camp is the chief and most feasible answer to the needs of thousands of children in metropolitan areas like Chicago—children who crave outdoor experiences and outdoor education but would not get them otherwise, because there are not sufficient field trips and there can *never* be sufficient school camps or overnite group camps for more than a small fraction of them. Our 165 picnic centers on the fringes of our forest preserves, which would otherwise stand virtually unused in the daytimes from Monday to Friday, inclusive, provide all the necessary facilities for day camps. The agencies must provide transportation, perhaps the noon meals, well-planned appropriate programs, and adequate trained leadership.

In smaller cities and towns, and particularly in predominately rural counties, school forests offer opportunity for nature programs. In Glencoe, one of our

wealthy North Shore suburbs, by teamwork between the schools, the park department and the recreation department, they have demonstrated the incalculable value of a bird sanctuary, and a wildflower sanctuary, on school or park property. The old rail fences around them, the top-soiling, and the planting were largely done by the sophisticated brats themselves. Now Glencoe is going in for school camping and a year-round nature program, and have hired one of my finest naturalists—a teacher of zoology and a specialist on visual aids—on a 12-month basis—at a salary that beats mine. There are comparable programs in various parts of the country, such as in New Haven.

Each fall, my department cooperates with the Chicago Teachers College, which trains teachers for the Chicago Public Schools, in giving a course in field biology. It includes six all-day field trips on Saturdays and was developed around the new courses in science now taught in the Chicago schools. We are working toward the same thing for the reverend sisters teaching biology or natural science in the Catholic schools. I have with me, for those interested in the techniques of teacher training, sufficient copies of a very fine article, "Teachers in Jeans" by a participant in one of those courses. We now plan a six-week summer school course in field biology for teachers in service and science majors in the Chicago Teachers College. They learn by doing.

I realize that I have dealt largely with techniques employed in a special situation in a peculiar area—the Chicago region. But I believe those techniques to be basic and applicable, with appropriate modification, most anywhere. I've always remembered something Paul B. Sears once said—at Gatlinburg, I believe—"Human behavior"—and I would add "human use of land"—"is shaped and formed according to the prevailing culture. In small groups of people, living simply, that culture form is simple. In a great and diverse nation that culture is extremely complex, yet it is all a part of a great pattern." I submit that it is our problem to reduce the complexities of that pattern in terms of their simple common denominator—the land.

Let that settle a while and then add a dash of Aldo Leopold: "No important change in human conduct is ever accomplished without internal change in our intellectual emphases, our loyalties, our affections, and our convictions."

Now what do you see? I see Liberty Hyde Bailey's dictum: "Make children friends of things that grow. Unify into one organic whole a series of enterprises that are based upon the land."

## TEN "TRICKS OF THE TRADE"

Greetings . . .

Here are ten "Tricks of the Trade" I've used in my Biology classes. . . .

1. Biology classes have made BETO books—write-ups, pictures, photos, etc., giving *B*iological *E*xperiences, *T*houghts, and *O*bservations. Grand enthusiasm and splendid work.
2. *Laugh Books.* All pictures, *laughing*—cut outs, paintings, of laughing people and animals looking as tho they were laughing. We send these each holiday to Veterans' Hospitals; have had excellent responses.
3. *Curators' Club.* I teach *live* Biology—so have 2 pupils from each class—boy and girl—come in each morning (some get there as early as 7:15, I'm usually in by 7:00 or earlier). They clean cages, water plants and animals. These pupils are in the club (competition is very strong to be selected as a curator) considered an honor. One of our honors last year was to have Dr. Betty Lock-

wood as one of our guest speakers. (Had 6 Doctors as guests thru the year). She can tell you of our *live* club.

4. At Christmas time we have charts showing the live evergreens and a description of pines, firs, hemlocks, etc.; "Which is yours?" to help identify theirs at school and home.

5. We show movies at noon. Biological ones sometimes, others on conservation, comics, etc.; we charge 12c; and give dollars to SPCA, March of Dimes. (Once made $156 in 6 minutes for March of Dimes!) Also sent cash to small town in Greece to buy seeds for all 58 families there, also seeds to Poland, Norway, Germany and Japan.

6. Raised 3 dogs; called them Bio, Oly, and Gee—BIOLOGY. Also had 2 named Phylo and Onto, all from tiny pups to maturity. Also raised a Belgian hare for 5 years, and a squirrel for 3 years.

7. Pupils sign up to take animals home for holidays. Printed cards go along as to care; feeding; watering, etc. Permission slips come in first, giving permission from home.

8. Let Boy and Girl Scouts take over for the periods on *their days*. They always do fine work, showing links between Biology and Scouting; such as First Aid, trail making, bird lore, animal ways, and the like.

9. We have a Student Day, when all classes are taken over by pupils, from supervising principal to cleaning staff. (This was started by the Biology Department.) Teachers just browse thru classes, visit and see how fine work is being done by pupils.

10. For several years I had a Pre-Med Club with our Biology Department. The pupils were all going to be M.D.'s. We took trips to various medical houses, hospitals, etc. Pupils did work in local hospital; record room, feeding, ward duty, etc.

So—here are 10 of my "Tricks of the Trade"; maybe you can use some.

Sincerely—

H. THEODORE STUBBS,
*Weehawken High School,*
*Weehawken, New Jersey*

## HOW TO CENTRIFUGE A FEVER THERMOMETER MERCURY COLUMN DOWN

A recent house organ* advertises a shakedown case for sale with their clinical fever thermometers which is operated by twisting a double cord and then allowing it to unwind, thus spinning the case end over end with the top nearer the center of the radius.

Since we frequently take oral temperatures of an entire class, we are interested in a quick, certain safe method of getting the mercury column down.

We had available several empty thermometer cases *with screw-on tops*. In one instance we drilled a single central hole in the end of the cap of the plastic thermometer case and threaded both ends of a 16-inch-long string through the hole. This left an eight-inch loop projecting outside. Knots at the ends of the strings kept them from being pulled out. Put the thermometer in the case, bulb end down, screw on the cap, slip the loop over your index finger and whirl.

A second type of centrifuge was made in much the same way but using only a single strand of wire. The wire was knotted to hold it in the cap and then twisted around a nail driven in the end of a large dowel rod. As one whirls the stick, the thermometer case spins (like a psychrometer). Of several possibilities those two seemed the simplest and they function adequately. A third type also using a wire loop was made. Two opposite holes bored down one-half inch from the end of the thermometer case cap

* *CenCo. News Chat*, No. 70, Winter 1950–51, p. 88.

allowed us to use a narrow bail of stiff wire (as in any type of bucket or pail). This loop of wire can be spun around one's finger.

James M. Sanders,
*Chicago Teachers College,*
*Chicago, Illinois*

## AMERICAN CANCER SOCIETY

A well-rounded program of cancer education for secondary schools is being offered to administrators and teachers by the American Cancer Society. The program is designed for year-round integration with several subjects in addition to those of health education and general science. The materials were prepared with advisory help from the National Education Association and the United States Office of Education.

The program makes use of pamphlets, posters, films, lantern slides and special pictorial charts on the statistics and biology of cancer.

*From One Cell*, a 14½-minute color film for biology students, has been used in many secondary schools since its release last year. The film makes use of the framework of normal classroom discussion of cell growth and behavior to present cancer as a special aspect of the phenomenon of growth. Using both live action and diagrams, it discusses embryonic, regenerative and degenerative cell behavior. The abnormal growth of cancer is presented in terms which clarify concepts of normal growth and provoke interest in the unanswered questions of abnormal cell behavior.

The picture is distinguished by especially developed time-lapse sequences, showing highly magnified specimens of normal and abnormal living tissue. The film is designed for biology classroom use. It is not recommended for use in general school assemblies.

A folder called *Why Learn About Cancer?* explains to secondary school students that the disease primarily is one of older people. "But," it points out, "if you learn a few simple facts about the disease you may be able to save the life of someone in your family or of a friend . . . and, some day, even your own."

Dr. Worth McClure, Executive Secretary of the American Association of School Administrators of the NEA and Dr. Paul Elicker, Executive Secretary of the National Association of Secondary School Principals of the NEA, distributed 32,500 copies of the ACS booklet, *Teaching About Cancer*, to the members of their Associations.

A syllabus for classroom use by teachers, *Suggestions on What to Teach About Cancer*, also has been distributed widely. Dr. Lyle W. Ashby, NEA assistant secretary for professional relations, and member of the ACS advisory committee, called it "one of the finest examples of a lay group working with the professional advice of educators in preparing materials before presenting them to schools."

All of the ACS educational tools and resource materials are available locally through division offices of the Society in the 48 states, Alaska and Puerto Rico. Administrators and teachers may inquire as to the free availability of the materials from these offices.